

FORMALITIES

The Applicants appreciate the Examiner providing a copy of Form PTO 1449, which was filed on October 3, 2002, that has been duly initialed. However, the Applicants respectfully request that the Examiner provide Applicants with a copy of the PTO Form 1449 that was filed contemporaneously with the application, which has been duly initialed by the Examiner as proof that the references contained therein have been considered.

REMARKS

Claims 1 through 9 are pending in the subject application. Claims 1-5 stand rejected under 35 U.S.C. 102(e) and 103(a). Claims 6-9 have been allowed. Claims 1 and 2 have been amended.

The Applicants appreciate the Examiner's thorough examination of the subject application and respectfully request reconsideration of the subject application based on the above amendments and the following remarks.

35 U.S.C. § 102(e) REJECTION

The Examiner has rejected claims 1 and 2 under 35 USC 102(e) as being anticipated by U.S. Patent Number 6,303,408 to Smith, et al. ("Smith" or the "Smith Reference"). The Applicants respectfully traverse these rejections for reasons detailed below.

The Smith reference discloses conductive elements 22 for an electronic assembly 20 wherein the conductive elements 22 are disposed between a first micro-electric assembly 24 and a second micro-electric assembly 30 and, further, include a core 40 and a fusible conductive material 42. At normal operating temperatures the fusible conductive material 42 at least partially liquefies thereby relieving thermally-induced stress and enabling the assembly to displace in a planar, i.e., x- and y-,

direction. See, e.g., Smith, Abstract; col. 8, lines 37-46. Thus, during operation of the assembly or during soldering in manufacture, the fusible conductive material 42 is free to move as described in col. 8 at lines 37-46.

In contrast, the connection of the invention as claimed combines an inner area comprising single-layer connection materials 3, which are provided for alignment purposes, and composite connection materials 9, which are disposed about an outer perimeter and at corners to provide resistance to bending and distortion due to heating during normal operation, respectively. See, e.g., Specification, page, 15, line 29 to page 16, line 26. Moreover, according to the present invention, each of the composite connection materials 9 includes a core 1 and a conductor covering 2, wherein, at room temperature, the modulus of elasticity of the core 1 is less than the modulus of elasticity of the covering 2.

As such, the present invention can address problems associated with heat generation during manufacture, i.e., when the semiconductor chip is mounted (soldered) on a substrate, and at normal operating temperatures. During the former, a self-alignment function that is mainly due to the conductor of the single-layer connection material 3 allows one to arrange the electrodes of the semiconductor accurately on corresponding electrodes of a substrate. Yet, at temperatures associated with soldering, the amount of the conductor of the composite connection material 9 is insufficient for gaining enough surface tension to achieve the above-mentioned self-alignment.

As to the latter, the low modulus of elasticity of the core 1 in the composite connection material 9 increases the deformability of the composite connection material 9 and, moreover, prevents crack development at normal operation temperatures. Without the composite connection material 9, cracking can begin at the connection part due to repeated heat stress.

The Smith reference, therefore, does not teach connection materials that combine composite connection materials with single-layer connection materials. Each of the Smith connections is a composite conductive element 22 comprising an inner core 40 and a fusible conductive material cover 42. Smith simply does not teach, mention or suggest including single-layer connection materials 3 for alignment purposes. Furthermore, Smith teaches providing a fusible conductive material 42 that will melt at normal operating temperatures whereas the invention as claimed teaches a core 1 and a conductor covering 2, wherein, at room temperature, the modulus of elasticity of the core 1 is less than the modulus of elasticity of the covering 2. Low modulus of elasticity is not an inherent property of materials with melting points in the range above room temperature and below 150 degrees Centigrade. Moreover, nothing in Smith teaches, mentions or suggests that the modulus of elasticity of the fusible conductive material 42 be greater than that of the core material 40.

Accordingly, the Smith reference does not anticipate the invention as claimed. Thus, it is respectfully submitted that, claims 1 and 2 and all dependent claims thereof are not anticipated or suggested by the Smith reference and, further, satisfy the requirements of 35 U.S.C. 100, et seq., especially § 102(c). Accordingly, claims 1 and 2 are allowable. Moreover, it is respectfully submitted that the subject application is in condition for allowance. Early and favorable action is requested.

35 U.S.C. § 103(a) REJECTION

The Examiner has rejected claims 3-5 under 35 USC 103(a) as being unpatentable over Smith. The Applicants respectfully traverse these rejections for the same reasons provided above. In short, the Smith reference does not teach, mention or suggest connection materials that combine composite connection materials with single-layer connection materials. Further, the Smith reference does not teach, mention or suggest that the modulus of elasticity of the fusible conductive material be greater than that of the core material.

M. Yasuda, et al.
USSN: 10/040,804
Page 6

Accordingly, the Smith reference does not make the invention as claimed obvious. Thus, it is respectfully submitted that, claims 3-5 are not suggested or otherwise made obvious by the Smith reference and, further, satisfy the requirements of 35 U.S.C. 100, et seq., especially § 103(a). Accordingly, claims 3-5 are allowable. Moreover, it is respectfully submitted that the subject application is in condition for allowance. Early and favorable action is requested.

The Applicants believe that no additional fee is required for consideration of the within Response. However, if for any reason the fee paid is inadequate or credit is owed for any excess fee paid, you are hereby authorized and requested to charge Deposit Account No. **04-1105**.

Respectfully submitted,

Date: May, 2003

By: 

George W. Hartnell, III
Reg. No. 42,639
Attorney for Applicant(s)

EDWARDS & ANGELL, LLP
P.O. Box 9169
Boston, MA 02209
(617) 517-5523
Customer No. 21874
326958

ANNEX TO AMENDMENT CONTAINING
MARKED-UP VERSIONS OF AMENDED CLAIMS

1. (Twice Amended) An electronic component including: ~~on electrodes;~~ a plurality of ~~connection materials~~ electrodes deployed on a same plane surface and connected to another electronic component and connection materials placed on said electrodes,
said connection materials placed on said electrodes including
a composite connection material formed of a core and a conductor covering said core, said core having a low modulus of elasticity at room temperature smaller than a modulus of elasticity of said conductor at room temperature, and
a single-layer connection material formed of a conductor alone,
wherein said composite connection material and said single-layer connection material
selectively occupy said electrodes, respectively.
2. (Amended) The electronic component according to claim 1, wherein
said composite connection material is placed on an electrode among electrodes arranged in an electrode region of said electronic component, said electrode being located in an area where a relatively greater stress is likely to be exerted repeatedly
than a stress exerted on another area of the electrode region due to heat generated
during operation of said electronic component, and said single-layer connection material is placed on an electrode in said another area.